

SEQUENCE LISTING

<110> Bidney, Dennis L.
Crasta, Oswald R.
Duvick, Jon
Hu, Xu
Lu, Guihua

<120> Sunflower Anti-Pathogenic Proteins and
Genes and their Uses

<130> 5718-90

<150> 60/140,646

<151> 1999-06-23

<150> 60/162,904

<151> 1999-11-01

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Asn	Tyr	Asn	Asp	Leu	Asp	Leu	Gly	Phe	Asp	Ser	Ala	Ala	Tyr	Glu	Glu
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 <212> PRT
 <213> Helianthus annuus

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Lys	Ala	Ser	Gln	Thr	Trp	Ser	Gly	Thr	Cys	Gly	Lys	Thr	Lys	His	Cys
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Val	Arg	Asp	Gly	Lys	His	Met	Cys	Phe	Cys	Tyr	Phe	Asn	Cys	Ser	Lys
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gcaggagccc	gtatatggcc	ccgaaccaat	tgcaactttg	atggttcttg	gcgaggcagg	240
tgtcagaccg	gtgattgcaa	cgtctctctc	caatgccaaa	actatggtac	cccacccaac	300
acattggccg	agtacgcttt	gaaccagttc	aacaatcttg	atttctttga	catttctctt	360
gtggacggat	tcaatgtgcc	gatggtgttt	agaccaattt	ctaattgggtg	caccgggggt	420
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 <213> Helianthus annuus

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aattattaat	taagagtcaa	aagtcgatta	cttttgtgtt	tgggtgccttg	tgtaccaatt	1740
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 aataatgcag tgaaaagaag cattttataa gtatataaaa gtgatttaat tagcttttat 1200
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 <213> Vitis vinifera

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 Cys Ser Tyr Thr Val Trp Ala Ala Val Pro Gly Gly Gly Met Gln
 35 40 45
 Leu Gly Ser Gly Gln Ser Trp Ser Leu Asn Val Asn Ala Gly Thr Thr
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 Gly Ala Arg Val Trp Gly Arg Thr Asn Cys Asn Phe Asp Ala Ser Gly
 65 70 75 80
 Asn Gly Lys Cys Glu Thr Gly Asp Cys Gly Gly Leu Leu Gln Cys Thr
 85 90 95
 Ala Tyr Gly Thr Pro Pro Asn Thr Leu Ala Glu Phe Ala Leu Asn Gln
 100 105 110
 Phe Ser Asn Leu Asp Phe Phe Asp Ile Ser Leu Val Asp Gly Phe Asn
 115 120 125
 Val Pro Met Ala Phe Asn Pro Thr Ser Asn Gly Cys Thr Arg Gly Ile
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 Ser Cys Thr Ala Asp Ile Val Gly Glu Cys Pro Ala Ala Leu Lys Thr
 145 150 155 160
 Thr Gly Gly Cys Asn Asn Pro Cys Thr Val Phe Lys Thr Asp Glu Tyr
 165 170 175
 Cys Cys Asn Ser Gly Ser Cys Asn Ala Thr Thr Tyr Ser Glu Phe Phe
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 Pro
 225

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 <213> Vitis vinifera

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Asn	Pro	Cys	Thr	Val	Phe	Lys	Thr	Asn	Glu	Tyr	Cys	Cys	Thr	Asp	Gly
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Ala	Arg	Phe	Glu	Ile	Thr	Asn	Arg	Cys	Thr	Tyr	Thr	Val	Trp	Ala	Ala
1			5					10					15		
Ser	Val	Pro	Val	Gly	Gly	Gly	Val	Gln	Leu	Asn	Pro	Gly	Gln	Ser	Trp
			20					25					30		
Ser	Val	Asp	Val	Pro	Ala	Gly	Thr	Lys	Gly	Ala	Arg	Val	Trp	Ala	Arg
		35					40					45			
Thr	Gly	Cys	Asn	Phe	Asp	Gly	Ser	Gly	Arg	Gly	Gly	Cys	Gln	Thr	Gly
	50					55					60				
Asp	Cys	Gly	Gly	Val	Leu	Asp	Cys	Lys	Ala	Tyr	Gly	Ala	Pro	Pro	Asn
65				70						75					80
Thr	Leu	Ala	Glu	Tyr	Gly	Leu	Asn	Gly	Phe	Asn	Asn	Leu	Asp	Phe	Phe
			85					90					95		
Asp	Ile	Ser	Leu	Val	Asp	Gly	Phe	Asn	Val	Pro	Met	Asp	Phe	Ser	Pro
			100					105					110		
Thr	Ser	Asn	Gly	Cys	Thr	Arg	Gly	Ile	Ser	Cys	Thr	Ala	Asp	Ile	Asn
		115					120					125			
Gly	Gln	Cys	Pro	Ser	Glu	Leu	Lys	Thr	Gln	Gly	Gly	Cys	Asn	Asn	Pro
	130					135					140				
Cys	Thr	Val	Phe	Lys	Thr	Asp	Gln	Tyr	Cys	Cys	Asn	Ser	Gly	Ser	Cys
145					150					155					160
Gly	Pro	Thr	Asp	Tyr	Ser	Arg	Phe	Phe	Lys	Gln	Arg	Cys	Pro	Asp	Ala
			165						170					175	
Tyr	Ser	Tyr	Pro	Lys	Asp	Asp	Pro	Pro	Ser	Thr	Phe	Thr	Cys	Asn	Gly
			180					185					190		
Gly	Thr	Asp	Tyr	Arg	Val	Val	Phe	Cys	Pro						
	195						200								

<210> 13
 <211> 223

<212> PRT

<213> Helianthus annuus

<400> 13

Met	Thr	Thr	Ser	Thr	Leu	Pro	Thr	Phe	Leu	Leu	Leu	Ala	Ile	Leu	Phe
1				5					10					15	
His	Tyr	Thr	Asn	Ala	Ala	Val	Phe	Thr	Ile	Arg	Asn	Asn	Cys	Pro	Tyr
			20					25					30		
Thr	Val	Trp	Ala	Gly	Ala	Val	Pro	Gly	Gly	Gly	Arg	Gln	Leu	Asn	Ser
		35					40					45			
Gly	Gln	Thr	Trp	Ser	Leu	Thr	Val	Ala	Ala	Gly	Thr	Ala	Gly	Ala	Arg
	50					55					60				
Ile	Trp	Pro	Arg	Thr	Asn	Cys	Asn	Phe	Asp	Gly	Ser	Gly	Arg	Gly	Arg
65					70				75						80
Cys	Gln	Thr	Gly	Asp	Cys	Asn	Gly	Leu	Leu	Gln	Cys	Gln	Asn	Tyr	Gly
				85				90						95	
Thr	Pro	Pro	Asn	Thr	Phe	Gly	Ser	Glu	Tyr	Ala	Leu	Asn	Gln	Phe	Asn
			100					105					110		
Asn	Leu	Asp	Phe	Phe	Asp	Ile	Ser	Leu	Val	Asp	Gly	Phe	Asn	Val	Pro
		115					120					125			
Met	Val	Phe	Arg	Pro	Asn	Ser	Asn	Gly	Cys	Thr	Arg	Gly	Ile	Ser	Cys
	130					135					140				
Thr	Ala	Asp	Ile	Asn	Gly	Gln	Cys	Pro	Gly	Glu	Leu	Arg	Ala	Pro	Gly
145					150					155					160
Gly	Cys	Asn	Asn	Pro	Cys	Thr	Val	Tyr	Lys	Thr	Asp	Gln	Tyr	Cys	Cys
				165					170					175	
Asn	Ser	Gly	Asn	Cys	Gly	Pro	Thr	Asp	Leu	Ser	Arg	Phe	Phe	Lys	Thr
			180					185					190		
Arg	Cys	Pro	Asp	Ala	Tyr	Ser	Tyr	Pro	Lys	Asp	Asp	Pro	Thr	Ser	Thr
		195					200					205			
Phe	Thr	Cys	Pro	Gly	Gly	Thr	Asn	Tyr	Asp	Val	Ile	Phe	Cys	Pro	
	210					215					220				

<210> 14

<211> 238

<212> PRT

<213> Lycopersicon esculentum

<400> 14

Phe	Phe	Phe	Leu	Leu	Ala	Phe	Val	Thr	Tyr	Thr	Tyr	Ala	Ala	Thr	Phe
1				5					10					15	
Glu	Val	Arg	Asn	Asn	Cys	Pro	Tyr	Thr	Val	Trp	Ala	Ala	Ser	Thr	Pro
			20					25					30		
Ile	Gly	Gly	Gly	Arg	Arg	Leu	Asp	Arg	Gly	Gln	Thr	Trp	Val	Ile	Asn
		35					40					45			
Ala	Pro	Arg	Gly	Thr	Lys	Met	Ala	Arg	Ile	Trp	Gly	Arg	Thr	Asn	Cys
	50					55					60				
Asn	Phe	Asp	Gly	Asp	Gly	Arg	Gly	Ser	Cys	Gln	Thr	Gly	Asp	Cys	Gly
65					70					75					80
Gly	Val	Leu	Gln	Cys	Thr	Gly	Trp	Gly	Lys	Pro	Pro	Asn	Thr	Leu	Ala
				85					90					95	
Glu	Tyr	Ala	Leu	Asp	Gln	Phe	Ser	Asn	Leu	Asp	Phe	Trp	Asp	Ile	Ser
		100						105					110		
Leu	Val	Asp	Gly	Phe	Asn	Ile	Pro	Met	Thr	Phe	Ala	Pro	Thr	Asn	Pro
		115					120					125			
Ser	Gly	Gly	Lys	Cys	His	Ala	Ile	His	Cys	Thr	Ala	Asn	Ile	Asn	Gly
	130					135					140				

Glu	Cys	Pro	Gly	Ser	Leu	Arg	Val	Pro	Gly	Gly	Cys	Asn	Asn	Pro	Cys
145					150					155					160
Thr	Thr	Phe	Gly	Gly	Gln	Gln	Tyr	Cys	Cys	Thr	Gln	Gly	Pro	Cys	Gly
			165						170						175
Pro	Thr	Asp	Leu	Ser	Arg	Phe	Phe	Lys	Gln	Arg	Cys	Pro	Asp	Ala	Tyr
			180					185					190		
Ser	Tyr	Pro	Gln	Asp	Asp	Pro	Thr	Ser	Thr	Phe	Thr	Cys	Pro	Ser	Gly
		195					200					205			
Ser	Thr	Asn	Tyr	Arg	Val	Val	Phe	Cys	Pro	Asn	Gly	Val	Thr	Ser	Pro
	210					215					220				
Asn	Phe	Pro	Leu	Glu	Met	Pro	Ser	Ser	Asp	Glu	Glu	Ala	Lys		
225					230					235					

<210> 15
 <211> 246
 <212> PRT
 <213> Solanum commersonii

<400> 15															
Met	Ala	Tyr	Leu	Arg	Ser	Ser	Phe	Val	Phe	Phe	Leu	Leu	Ala	Phe	Val
1			5						10					15	
Thr	Tyr	Thr	Tyr	Ala	Ala	Thr	Ile	Glu	Val	Arg	Asn	Asn	Cys	Pro	Tyr
			20					25					30		
Thr	Val	Trp	Ala	Ala	Ser	Thr	Pro	Ile	Gly	Gly	Gly	Arg	Arg	Leu	Asp
		35					40					45			
Arg	Gly	Gln	Thr	Trp	Val	Ile	Asn	Ala	Pro	Arg	Gly	Thr	Lys	Met	Ala
	50					55					60				
Arg	Ile	Trp	Gly	Arg	Thr	Asn	Cys	Asn	Phe	Asp	Gly	Ala	Gly	Arg	Gly
65					70					75				80	
Ser	Cys	Gln	Thr	Gly	Asp	Cys	Gly	Gly	Val	Leu	Gln	Cys	Thr	Gly	Trp
				85					90					95	
Gly	Lys	Pro	Pro	Asn	Thr	Leu	Ala	Glu	Tyr	Ala	Leu	Asp	Gln	Phe	Ser
			100					105					110		
Asn	Leu	Asp	Phe	Trp	Asp	Ile	Ser	Leu	Val	Asp	Gly	Phe	Asn	Ile	Pro
		115					120					125			
Met	Thr	Phe	Ala	Pro	Thr	Asn	Pro	Ser	Gly	Gly	Lys	Cys	His	Ala	Ile
	130					135					140				
His	Cys	Thr	Ala	Asn	Ile	Asn	Gly	Glu	Cys	Pro	Gly	Ser	Leu	Arg	Val
145					150					155					160
Pro	Gly	Gly	Cys	Asn	Pro	Cys	Thr	Thr	Phe	Gly	Gly	Gln	Gln	Tyr	
				165					170					175	
Cys	Cys	Thr	Gln	Gly	Pro	Cys	Gly	Pro	Thr	Asp	Leu	Ser	Arg	Phe	Phe
			180					185					190		
Lys	Gln	Arg	Cys	Pro	Asp	Ala	Tyr	Ser	Tyr	Pro	Gln	Asp	Asp	Pro	Thr
		195					200					205			
Ser	Thr	Phe	Thr	Cys	Pro	Ser	Gly	Ser	Thr	Asn	Tyr	Arg	Val	Val	Phe
	210					215					220				
Cys	Pro	Asn	Gly	Val	Thr	Ser	Pro	Asn	Phe	Pro	Leu	Glu	Met	Pro	Ala
225					230					235					240
Ser	Asp	Glu	Glu	Ala	Lys										
				245											

<210> 16
 <211> 529
 <212> PRT
 <213> Helianthus annuus

<400> 16

Met	Glu	Thr	Ser	Ile	Leu	Thr	Leu	Leu	Leu	Leu	Leu	Ser	Thr	Gln
1				5					10				15	
Ser	Ser	Ala	Thr	Ser	Arg	Ser	Ile	Thr	Asp	Arg	Phe	Ile	Gln	Cys
			20					25					30	Leu
His	Asp	Arg	Ala	Asp	Pro	Ser	Phe	Pro	Ile	Thr	Gly	Glu	Val	Tyr
		35					40					45		Thr
Pro	Gly	Asn	Ser	Ser	Phe	Pro	Thr	Val	Leu	Gln	Asn	Tyr	Ile	Arg
	50					55					60			Asn
Leu	Arg	Phe	Asn	Glu	Thr	Thr	Thr	Pro	Lys	Pro	Phe	Leu	Ile	Ile
65					70					75				80
Ala	Glu	His	Val	Ser	His	Ile	Gln	Ala	Ala	Val	Val	Cys	Gly	Lys
				85				90						95
Asn	Arg	Leu	Leu	Leu	Lys	Thr	Arg	Ser	Gly	Gly	His	Asp	Tyr	Glu
			100					105					110	Gly
Leu	Ser	Tyr	Leu	Thr	Asn	Thr	Asn	Gln	Pro	Phe	Phe	Ile	Val	Asp
	115						120					125		Met
Phe	Asn	Leu	Arg	Ser	Ile	Asn	Val	Asp	Ile	Glu	Gln	Glu	Thr	Ala
	130					135					140			Trp
Val	Gln	Ala	Gly	Ala	Thr	Leu	Gly	Glu	Val	Tyr	Tyr	Arg	Ile	Ala
145					150					155				Glu
Lys	Ser	Asn	Lys	His	Gly	Phe	Pro	Ala	Gly	Val	Cys	Pro	Thr	Val
				165				170						Gly
Val	Gly	Gly	His	Phe	Ser	Gly	Gly	Gly	Tyr	Gly	Asn	Leu	Met	Arg
			180					185					190	Lys
Tyr	Gly	Leu	Ser	Val	Asp	Asn	Ile	Val	Asp	Ala	Gln	Ile	Ile	Asp
		195				200					205			Val
Asn	Gly	Lys	Leu	Leu	Asp	Arg	Lys	Ser	Met	Gly	Glu	Asp	Leu	Phe
	210					215					220			Trp
Ala	Tyr	Thr	Gly	Gly	Gly	Gly	Val	Ser	Phe	Gly	Val	Val	Leu	Ala
225				230						235				Tyr
Lys	Ile	Lys	Leu	Val	Arg	Val	Pro	Glu	Val	Val	Thr	Val	Phe	Thr
				245				250						Ile
Glu	Arg	Arg	Glu	Glu	Gln	Asn	Leu	Ser	Thr	Ile	Ala	Glu	Arg	Trp
			260					265					270	Val
Gln	Val	Ala	Asp	Lys	Leu	Asp	Arg	Asp	Leu	Phe	Leu	Arg	Met	Thr
		275					280					285		Phe
Ser	Val	Ile	Asn	Asp	Thr	Asn	Gly	Gly	Lys	Thr	Val	Arg	Ala	Ile
	290					295					300			Phe
Pro	Thr	Leu	Tyr	Leu	Gly	Asn	Ser	Arg	Asn	Leu	Val	Thr	Leu	Leu
305				310						315				Asn
Lys	Asp	Phe	Pro	Glu	Leu	Gly	Leu	Gln	Glu	Ser	Asp	Cys	Thr	Glu
				325				330						Met
Ser	Trp	Val	Glu	Ser	Val	Leu	Tyr	Tyr	Thr	Gly	Phe	Pro	Ser	Gly
			340					345					350	Thr
Pro	Thr	Thr	Ala	Leu	Leu	Ser	Arg	Thr	Pro	Gln	Arg	Leu	Asn	Pro
	355					360						365		Phe
Lys	Ile	Lys	Ser	Asp	Tyr	Val	Gln	Asn	Pro	Ile	Ser	Lys	Arg	Gln
	370					375					380			Phe
Glu	Phe	Ile	Phe	Glu	Arg	Met	Lys	Glu	Leu	Glu	Asn	Gln	Met	Leu
385				390						395				Ala
Phe	Asn	Pro	Tyr	Gly	Gly	Arg	Met	Ser	Glu	Ile	Ser	Glu	Phe	Ala
				405				410						Lys
Pro	Phe	Pro	His	Arg	Ser	Gly	Asn	Ile	Ala	Lys	Ile	Gln	Tyr	Glu
			420				425						430	Val
Asn	Trp	Glu	Asp	Leu	Ser	Asp	Glu	Ala	Glu	Asn	Arg	Tyr	Leu	Asn
		435					440						445	Phe

Thr	Arg	Leu	Met	Tyr	Asp	Tyr	Met	Thr	Pro	Phe	Val	Ser	Lys	Asn	Pro
450						455					460				
Arg	Glu	Ala	Phe	Leu	Asn	Tyr	Arg	Asp	Leu	Asp	Ile	Gly	Ile	Asn	Ser
465					470					475					480
His	Gly	Arg	Asn	Ala	Tyr	Thr	Glu	Gly	Met	Val	Tyr	Gly	His	Lys	Tyr
			485						490					495	
Phe	Lys	Glu	Thr	Asn	Tyr	Lys	Arg	Leu	Val	Ser	Val	Lys	Thr	Lys	Val
			500					505					510		
Asp	Pro	Asp	Asn	Phe	Phe	Arg	Asn	Glu	Gln	Ser	Ile	Pro	Thr	Leu	Ser
		515					520					525			

Ser

<210> 17
 <211> 529
 <212> PRT
 <213> Healianthus annuus

<400> 17

Met	Gln	Thr	Ser	Ile	Leu	Thr	Leu	Leu	Leu	Leu	Leu	Ser	Thr	Gln
1			5					10					15	
Ser	Ser	Ala	Thr	Ser	Arg	Ser	Ile	Thr	Asp	Arg	Phe	Ile	Gln	Cys
			20					25					30	Leu
His	Asp	Arg	Ala	Asp	Pro	Ser	Phe	Pro	Ile	Thr	Gly	Glu	Val	Tyr
		35					40					45		Thr
Pro	Gly	Asn	Ser	Ser	Phe	Pro	Thr	Val	Leu	Gln	Asn	Tyr	Ile	Arg
	50					55					60			Asn
Leu	Arg	Phe	Asn	Glu	Thr	Thr	Thr	Pro	Lys	Pro	Phe	Leu	Ile	Ile
65				70						75				80
Ala	Glu	His	Val	Ser	His	Ile	Gln	Ala	Ala	Val	Val	Cys	Gly	Lys
				85				90						95
Asn	Arg	Leu	Leu	Leu	Lys	Thr	Arg	Ser	Gly	Gly	His	Asp	Tyr	Glu
			100					105					110	Gly
Leu	Ser	Tyr	Leu	Thr	Asn	Thr	Asn	Gln	Pro	Phe	Phe	Ile	Val	Asp
		115					120					125		Met
Phe	Asn	Leu	Arg	Ser	Ile	Asn	Ile	Asp	Ile	Glu	Gln	Glu	Thr	Ala
	130					135					140			Trp
Val	Gln	Ala	Gly	Ala	Thr	Leu	Gly	Glu	Val	Tyr	Tyr	Arg	Ile	Ala
145					150					155				160
Lys	Ser	Asn	Lys	His	Gly	Phe	Pro	Ala	Gly	Val	Cys	Pro	Thr	Val
				165					170					175
Val	Gly	Gly	His	Phe	Ser	Gly	Gly	Gly	Tyr	Gly	Asn	Leu	Met	Arg
			180					185					190	Lys
Tyr	Gly	Leu	Ser	Val	Asp	Asn	Ile	Val	Asp	Ala	Gln	Ile	Ile	Asp
		195					200					205		Val
Asn	Gly	Lys	Leu	Leu	Asp	Arg	Lys	Ser	Met	Gly	Glu	Asp	Leu	Phe
	210					215					220			Trp
Ala	Ile	Thr	Gly	Gly	Gly	Gly	Val	Ser	Phe	Gly	Val	Val	Leu	Ala
225					230					235				240
Lys	Ile	Lys	Leu	Val	Arg	Val	Pro	Glu	Val	Val	Thr	Val	Phe	Thr
				245					250					255
Glu	Arg	Arg	Glu	Glu	Gln	Asn	Leu	Ser	Thr	Ile	Ala	Glu	Arg	Trp
			260					265					270	Val
Gln	Val	Ala	Asp	Lys	Leu	Asp	Arg	Asp	Leu	Phe	Leu	Arg	Met	Thr
		275					280					285		Phe
Ser	Val	Ile	Asn	Asp	Thr	Asn	Gly	Gly	Lys	Thr	Val	Arg	Ala	Ile
	290					295					300			

Pro Thr Leu Tyr Leu Gly Asn Ser Arg Asn Leu Val Thr Leu Leu Asn
 305 310 315 320
 Lys Asp Phe Pro Glu Leu Gly Leu Gln Glu Ser Asp Cys Thr Glu Met
 325 330 335
 Ser Trp Val Glu Ser Val Leu Tyr Tyr Thr Gly Phe Pro Ser Gly Thr
 340 345 350
 Pro Thr Thr Ala Leu Leu Ser Arg Thr Pro Gln Arg Leu Asn Pro Phe
 355 360 365
 Lys Ile Lys Ser Asp Tyr Val Gln Asn Pro Ile Ser Lys Arg Gln Phe
 370 375 380
 Glu Phe Ile Phe Glu Arg Leu Lys Glu Leu Glu Asn Gln Met Leu Ala
 385 390 395 400
 Phe Asn Pro Tyr Gly Gly Arg Met Ser Glu Ile Ser Glu Phe Ala Lys
 405 410 415
 Pro Phe Pro His Arg Ser Gly Asn Ile Ala Lys Ile Gln Tyr Glu Val
 420 425 430
 Asn Trp Glu Asp Leu Ser Asp Glu Ala Glu Asn Arg Tyr Leu Asn Phe
 435 440 445
 Thr Arg Leu Met Tyr Asp Tyr Met Thr Pro Phe Val Ser Lys Asn Pro
 450 455 460
 Arg Lys Ala Phe Leu Asn Tyr Arg Asp Leu Asp Ile Gly Ile Asn Ser
 465 470 475 480
 His Gly Arg Asn Ala Tyr Thr Glu Gly Met Val Tyr Gly His Lys Tyr
 485 490 495
 Phe Lys Glu Thr Asn Tyr Lys Arg Leu Val Ser Val Lys Thr Lys Val
 500 505 510
 Asp Pro Asp Asn Phe Phe Arg Asn Glu Gln Ser Ile Pro Thr Leu Ser
 515 520 525
 Ser

<210> 18
 <211> 535
 <212> PRT
 <213> Papaver somniferum

<400> 18
 Met Met Cys Arg Ser Leu Thr Leu Arg Phe Phe Leu Phe Ile Val Leu
 1 5 10 15
 Leu Gln Thr Cys Val Arg Gly Gly Asp Val Asn Asp Asn Leu Leu Ser
 20 25 30
 Ser Cys Leu Asn Ser His Gly Val His Asn Phe Thr Thr Leu Ser Thr
 35 40 45
 Asp Thr Asn Ser Asp Tyr Phe Lys Leu Leu His Ala Ser Met Gln Asn
 50 55 60
 Pro Leu Phe Ala Lys Pro Thr Val Ser Lys Pro Ser Phe Ile Val Met
 65 70 75 80
 Pro Gly Ser Lys Glu Glu Leu Ser Ser Thr Val His Cys Cys Thr Arg
 85 90 95
 Glu Ser Trp Thr Ile Arg Leu Arg Ser Gly Gly His Ser Tyr Glu Gly
 100 105 110
 Leu Ser Tyr Thr Ala Asp Thr Pro Phe Val Ile Val Asp Met Met Asn
 115 120 125
 Leu Asn Arg Ile Ser Ile Asp Val Leu Ser Glu Thr Ala Trp Val Glu
 130 135 140
 Ser Gly Ala Thr Leu Gly Glu Leu Tyr Tyr Ala Ile Ala Gln Ser Thr
 145 150 155 160

Asp Thr Leu Gly Phe Thr Ala Gly Trp Cys Pro Thr Val Gly Ser Gly
 165 170 175
 Gly His Ile Ser Gly Gly Gly Phe Gly Met Met Ser Arg Lys Tyr Gly
 180 185 190
 Leu Ala Ala Asp Asn Val Val Asp Ala Ile Leu Ile Asp Ser Asn Gly
 195 200 205
 Ala Ile Leu Asp Arg Glu Lys Met Gly Asp Asp Val Phe Trp Ala Ile
 210 215 220
 Arg Gly Gly Gly Gly Gly Val Trp Gly Ala Ile Tyr Ala Trp Lys Ile
 225 230 235 240
 Lys Leu Leu Pro Val Pro Glu Lys Leu Thr Val Phe Arg Val Thr Lys
 245 250 255
 Asn Val Gly Ile Glu Asp Ala Ser Ser Leu Leu His Lys Trp Gln Tyr
 260 265 270
 Val Ala Asp Glu Leu Asp Glu Asp Phe Thr Val Ser Val Leu Gly Gly
 275 280 285
 Val Asn Gly Asn Asp Ala Trp Leu Met Phe Leu Gly Leu His Leu Gly
 290 295 300
 Arg Lys Asp Ala Ala Lys Thr Ile Ile Asp Glu Lys Phe Pro Glu Leu
 305 310 315 320
 Gly Leu Val Asp Lys Glu Phe Gln Glu Met Ser Trp Gly Glu Ser Met
 325 330 335
 Ala Phe Leu Ser Gly Leu Asp Thr Ile Ser Glu Leu Asn Asn Arg Phe
 340 345 350
 Leu Lys Phe Asp Glu Arg Ala Phe Lys Thr Lys Val Asp Phe Thr Lys
 355 360 365
 Val Ser Val Pro Leu Asn Val Phe Arg His Ala Leu Glu Met Leu Ser
 370 375 380
 Glu Gln Pro Gly Gly Phe Ile Ala Leu Asn Gly Phe Gly Gly Lys Met
 385 390 395 400
 Ser Glu Ile Ser Thr Asp Phe Thr Pro Phe Pro His Arg Lys Gly Thr
 405 410 415
 Lys Leu Met Phe Glu Tyr Ile Ile Ala Trp Asn Gln Asp Glu Glu Ser
 420 425 430
 Lys Ile Gly Glu Phe Ser Glu Trp Leu Ala Lys Phe Tyr Asp Tyr Leu
 435 440 445
 Glu Pro Phe Val Ser Lys Glu Pro Arg Val Gly Tyr Val Asn His Ile
 450 455 460
 Asp Leu Asp Ile Gly Gly Ile Asp Trp Arg Asn Lys Ser Ser Thr Thr
 465 470 475 480
 Asn Ala Val Glu Ile Ala Arg Asn Trp Gly Glu Arg Tyr Phe Ser Ser
 485 490 495
 Asn Tyr Glu Arg Leu Val Lys Ala Lys Thr Leu Ile Asp Pro Asn Asn
 500 505 510
 Val Phe Asn His Pro Gln Ser Ile Pro Pro Met Met Lys Phe Glu Glu
 515 520 525
 Ile Tyr Met Leu Lys Glu Leu
 530 535

<210> 19

<211> 538

<212> PRT

<213> Eschscholzia californica

<400> 19

Met Glu Asn Lys Thr Pro Ile Phe Phe Ser Leu Ser Ile Phe Leu Ser
 1 5 10 15

Leu	Leu	Asn	Cys	Ala	Leu	Gly	Gly	Asn	Asp	Leu	Leu	Ser	Cys	Leu	Thr
			20					25					30		
Phe	Asn	Gly	Val	Arg	Asn	His	Thr	Val	Phe	Ser	Ala	Asp	Ser	Asp	Ser
		35					40					45			
Asp	Phe	Asn	Arg	Phe	Leu	His	Leu	Ser	Ile	Gln	Asn	Pro	Leu	Phe	Gln
	50					55					60				
Asn	Ser	Leu	Ile	Ser	Lys	Pro	Ser	Ala	Ile	Ile	Leu	Pro	Gly	Ser	Lys
65					70					75					80
Glu	Glu	Leu	Ser	Asn	Thr	Ile	Arg	Cys	Ile	Arg	Lys	Gly	Ser	Trp	Thr
				85					90					95	
Ile	Arg	Leu	Arg	Ser	Gly	Gly	His	Ser	Tyr	Glu	Gly	Leu	Ser	Tyr	Thr
			100					105					110		
Ser	Asp	Thr	Pro	Phe	Ile	Leu	Ile	Asp	Leu	Met	Asn	Leu	Asn	Arg	Val
		115					120					125			
Ser	Ile	Asp	Leu	Glu	Ser	Glu	Thr	Ala	Trp	Val	Glu	Ser	Gly	Ser	Thr
	130					135					140				
Leu	Gly	Glu	Leu	Tyr	Tyr	Ala	Ile	Thr	Glu	Ser	Ser	Ser	Lys	Leu	Gly
145					150					155					160
Phe	Thr	Ala	Gly	Trp	Cys	Pro	Thr	Val	Gly	Thr	Gly	Gly	His	Ile	Ser
			165						170					175	
Gly	Gly	Gly	Phe	Gly	Met	Met	Ser	Arg	Lys	Tyr	Gly	Leu	Ala	Ala	Asp
			180					185					190		
Asn	Val	Val	Asp	Ala	Ile	Leu	Ile	Asp	Ala	Asn	Gly	Ala	Ile	Leu	Asp
		195					200					205			
Arg	Gln	Ala	Met	Gly	Glu	Asp	Val	Phe	Trp	Ala	Ile	Arg	Gly	Gly	Gly
	210					215					220				
Gly	Gly	Val	Trp	Gly	Ala	Ile	Tyr	Ala	Trp	Lys	Ile	Lys	Leu	Leu	Pro
225					230					235					240
Val	Pro	Glu	Lys	Val	Thr	Val	Phe	Arg	Val	Thr	Lys	Asn	Val	Ala	Ile
				245					250					255	
Asp	Glu	Ala	Thr	Ser	Leu	Leu	His	Lys	Trp	Gln	Phe	Val	Ala	Glu	Glu
			260					265					270		
Leu	Glu	Glu	Asp	Phe	Thr	Leu	Ser	Val	Leu	Gly	Gly	Ala	Asp	Glu	Lys
		275					280					285			
Gln	Val	Trp	Leu	Thr	Met	Leu	Gly	Phe	His	Phe	Gly	Leu	Lys	Thr	Val
	290					295					300				
Ala	Lys	Ser	Thr	Phe	Asp	Leu	Leu	Phe	Pro	Glu	Leu	Gly	Leu	Val	Glu
305					310					315					320
Glu	Asp	Tyr	Leu	Glu	Met	Ser	Trp	Gly	Glu	Ser	Phe	Ala	Tyr	Leu	Ala
				325					330					335	
Gly	Leu	Glu	Thr	Val	Ser	Gln	Leu	Asn	Asn	Arg	Phe	Leu	Lys	Phe	Asp
			340					345					350		
Glu	Arg	Ala	Phe	Lys	Thr	Lys	Val	Asp	Leu	Thr	Lys	Glu	Pro	Leu	Pro
		355					360					365			
Ser	Lys	Ala	Phe	Tyr	Gly	Leu	Leu	Glu	Arg	Leu	Ser	Lys	Glu	Pro	Asn
		370				375					380				
Gly	Phe	Ile	Ala	Leu	Asn	Gly	Phe	Gly	Gly	Gln	Met	Ser	Lys	Ile	Ser
385					390					395					400
Ser	Asp	Phe	Thr	Pro	Phe	Pro	His	Arg	Ser	Gly	Thr	Arg	Leu	Met	Val
				405					410					415	
Glu	Tyr	Ile	Val	Ala	Trp	Asn	Gln	Ser	Glu	Gln	Lys	Lys	Lys	Thr	Glu
			420					425					430		
Phe	Leu	Asp	Trp	Leu	Glu	Lys	Val	Tyr	Glu	Phe	Met	Lys	Pro	Phe	Val
		435					440					445			
Ser	Lys	Asn	Pro	Arg	Leu	Gly	Tyr	Val	Asn	His	Ile	Asp	Leu	Asp	Leu
	450					455					460				
Gly	Gly	Ile	Asp	Trp	Gly	Asn	Lys	Thr	Val	Val	Asn	Asn	Ala	Ile	Glu

465					470					475					480
Ile	Ser	Arg	Ser	Trp	Gly	Glu	Ser	Tyr	Phe	Leu	Ser	Asn	Tyr	Glu	Arg
				485					490					495	
Leu	Ile	Arg	Ala	Lys	Thr	Leu	Ile	Asp	Pro	Asn	Asn	Val	Phe	Asn	His
			500					505					510		
Pro	Gln	Ser	Ile	Pro	Pro	Met	Ala	Asn	Phe	Asp	Tyr	Leu	Glu	Lys	Thr
		515					520					525			
Leu	Gly	Ser	Asp	Gly	Gly	Glu	Val	Val	Ile						
	530					535									

<210> 20
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 <212> PRT
 <213> Helianthus annuus

<400> 20

Met	Asn	Asn	Ser	Arg	Ser	Val	Phe	Leu	Leu	Val	Leu	Ala	Leu	Ser	Phe
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Cys	Val	Ser	Phe	Gly	Ala	Leu	Ser	Ser	Ile	Phe	Asp	Val	Thr	Ser	Thr
			20					25					30		
Ser	Glu	Asp	Phe	Ile	Thr	Cys	Leu	Gln	Ser	Asn	Ser	Asn	Asn	Val	Thr
		35					40					45			
Thr	Ile	Ser	Gln	Leu	Val	Phe	Thr	Pro	Ala	Asn	Thr	Ser	Tyr	Ile	Pro
	50					55					60				
Ile	Trp	Gln	Ala	Ala	Ala	Asp	Pro	Ile	Arg	Phe	Asn	Lys	Ser	Tyr	Ile
65					70					75					80
Pro	Lys	Pro	Ser	Val	Ile	Val	Thr	Pro	Thr	Asp	Glu	Thr	Gln	Ile	Gln
				85					90					95	
Thr	Ala	Leu	Leu	Cys	Ala	Lys	Lys	His	Gly	Tyr	Glu	Phe	Arg	Ile	Arg
			100					105					110		
Asp	Gly	Gly	His	Asp	Phe	Glu	Gly	Asn	Ser	Tyr	Thr	Ala	Asn	Ala	Pro
		115					120					125			
Phe	Val	Met	Leu	Asp	Leu	Val	Asn	Met	Arg	Ala	Ile	Glu	Ile	Asn	Val
	130					135					140				
Glu	Asn	Arg	Thr	Ala	Leu	Val	Gln	Gly	Gly	Ala	Leu	Leu	Gly	Glu	Leu
145					150					155					160
Tyr	Tyr	Thr	Ile	Ser	Gln	Lys	Thr	Asp	Thr	Leu	Tyr	Phe	Pro	Ala	Gly
				165					170					175	
Ile	Trp	Ala	Gly	Val	Gly	Val	Ser	Gly	Phe	Leu	Ser	Gly	Gly	Gly	Tyr
			180					185						190	
Gly	Asn	Leu	Leu	Arg	Lys	Tyr	Gly	Leu	Gly	Ala	Asp	Asn	Val	Leu	Asp
		195					200					205			
Ile	Arg	Phe	Met	Asp	Val	Asn	Gly	Asn	Ile	Leu	Asp	Arg	Lys	Ser	Met
	210					215					220				
Gly	Glu	Asp	Leu	Phe	Trp	Ala	Leu	Arg	Gly	Gly	Gly	Ala	Ser	Ser	Phe
225					230					235					240
Gly	Ile	Val	Leu	Gln	Trp	Lys	Leu	Asn	Leu	Val	Pro	Val	Pro	Glu	Arg
				245					250					255	
Val	Thr	Leu	Phe	Ser	Val	Ser	Tyr	Thr	Leu	Glu	Gln	Gly	Ala	Thr	Asp
			260					265					270		
Ile	Phe	His	Lys	Tyr	Gln	Tyr	Val	Leu	Pro	Lys	Phe	Asp	Arg	Asp	Leu
	275						280					285			
Leu	Ile	Arg	Val	Gln	Leu	Asn	Thr	Glu	Tyr	Ile	Gly	Asn	Thr	Thr	Gln
	290					295					300				
Lys	Thr	Val	Arg	Ile	Leu	Phe	His	Gly	Ile	Tyr	Gln	Gly	Asn	Ile	Asp
305					310					315					320
Thr	Leu	Leu	Pro	Leu	Leu	Asn	Gln	Ser	Phe	Pro	Glu	Leu	Asn	Val	Thr

				325					330					335					
Arg	Glu	Val	Cys	Gln	Glu	Val	Arg	Met	Val	Gln	Thr	Thr	Leu	Glu	Phe				
			340					345					350						
Gly	Gly	Phe	Asn	Ile	Ser	Thr	Pro	Thr	Ser	Val	Leu	Ala	Asn	Arg	Ser				
		355					360					365							
Ala	Ile	Pro	Lys	Leu	Ser	Phe	Lys	Gly	Lys	Ser	Asp	Tyr	Val	Arg	Thr				
	370					375					380								
Pro	Ile	Pro	Arg	Ser	Gly	Leu	Arg	Lys	Leu	Trp	Arg	Lys	Met	Phe	Glu				
385					390					395					400				
Asn	Asp	Asn	Ser	Gln	Thr	Leu	Phe	Met	Tyr	Thr	Phe	Gly	Gly	Lys	Met				
			405					410						415					
Glu	Glu	Tyr	Ser	Asp	Thr	Ala	Ile	Pro	Tyr	Pro	His	Arg	Ala	Gly	Val				
		420						425					430						
Leu	Tyr	Gln	Val	Phe	Lys	Arg	Val	Asp	Phe	Val	Asp	Gln	Pro	Ser	Asp				
	435						440					445							
Lys	Thr	Leu	Ile	Ser	Leu	Arg	Arg	Leu	Ala	Trp	Leu	Arg	Ser	Phe	Asp				
	450					455					460								
Lys	Thr	Leu	Glu	Pro	Tyr	Val	Thr	Ser	Asn	Pro	Arg	Glu	Ala	Tyr	Met				
465				470						475					480				
Asn	Tyr	Asn	Asp	Leu	Asp	Leu	Gly	Phe	Asp	Ser	Ala	Ala	Tyr	Glu	Glu				
			485					490						495					
Ala	Ser	Glu	Trp	Gly	Glu	Arg	Tyr	Trp	Lys	Arg	Glu	Asn	Phe	Lys	Lys				
		500						505					510						
Leu	Ile	Arg	Ile	Lys	Ala	Lys	Val	Asp	Pro	Glu	Asn	Phe	Phe	Arg	His				
	515						520					525							
Pro	Gln	Ser	Ile	Pro	Val	Phe	Ser	Arg	Pro	Leu	Ser	Asp	Met						
	530					535					540								

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 <211> 80
 <212> PRT
 <213> Raphanus sativus

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Val	Phe	Ala	Ala	Phe	Glu	Glu	Pro	Thr	Met	Val	Glu	Ala	Gln	Lys	Leu				
		20						25					30						
Cys	Gln	Arg	Pro	Ser	Gly	Thr	Trp	Ser	Gly	Val	Cys	Gly	Asn	Asn	Asn				
	35						40				45								
Ala	Cys	Lys	Asn	Gln	Cys	Ile	Arg	Leu	Glu	Lys	Ala	Arg	His	Gly	Ser				
	50					55					60								
Cys	Asn	Tyr	Val	Phe	Pro	Ala	His	Lys	Cys	Ile	Cys	Tyr	Phe	Pro	Cys				
65					70					75					80				

<210> 22
 <211> 51
 <212> PRT
 <213> Sinapis alba

Gln	Lys	Leu	Cys	Glu	Arg	Pro	Ser	Gly	Thr	Trp	Ser	Gly	Val	Cys	Gly				
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Asn	Asn	Asn	Ala	Cys	Lys	Asn	Gln	Cys	Ile	Asn	Leu	Glu	Lys	Ala	Arg				
		20						25					30						
His	Gly	Ser	Cys	Asn	Tyr	Val	Phe	Pro	Ala	His	Lys	Cys	Ile	Cys	Tyr				
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Phe Pro Cys
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<212> PRT
<213> Arabidopsis thaliana

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Phe Phe Ala Ala Leu Glu Ala Pro Met Val Val Glu Ala Gln Lys Leu
20 25 30
Cys Glu Arg Pro Ser Gly Thr Trp Ser Gly Val Cys Gly Asn Ser Asn
35 40 45
Ala Cys Lys Asn Gln Cys Ile Asn Leu Glu Lys Ala Arg His Gly Ser
50 55 60
Cys Asn Tyr Val Phe Pro Ala His Lys Cys Ile Cys Tyr Phe Pro Cys
65 70 75 80

<210> 24
<211> 108
<212> PRT
<213> Helianthus annuus

<400> 24
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Val Leu Ala Ile Ser Glu Ile Gly Ser Val Lys Gly Glu Leu Cys Glu
20 25 30
Lys Ala Ser Gln Thr Trp Ser Gly Thr Cys Gly Lys Thr Lys His Cys
35 40 45
Asp Asp Gln Cys Lys Ser Trp Glu Gly Ala Ala His Gly Ala Cys His
50 55 60
Val Arg Asp Gly Lys His Met Cys Phe Cys Tyr Phe Asn Cys Ser Lys
65 70 75 80
Ala Gln Lys Leu Ala Gln Asp Lys Leu Arg Ala Glu Glu Leu Ala Lys
85 90 95
Glu Lys Ile Glu Pro Glu Lys Ala Thr Ala Lys Pro
100 105

<210> 25
<211> 100
<212> PRT
<213> Pisum sativum

<400> 25
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1 5 10 15
Leu Phe Val Ala Gln Glu Ile Val Val Thr Glu Ala Asn Thr Cys Glu
20 25 30
His Leu Ala Asp Thr Tyr Arg Gly Val Cys Phe Thr Asn Ala Ser Cys
35 40 45
Asp Asp His Cys Lys Asn Lys Ala His Leu Ile Ser Gly Thr Cys His
50 55 60
Asp Trp Lys Cys Phe Cys Thr Gln Asn Cys Glu Arg Arg Arg Asn Lys
65 70 75 80

Asn Trp Asn Asp Cys Met Glu Asn Thr Pro Arg Pro Glu Arg Thr Tyr	
85	90
95	
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tccggctcgt atgttgtgtg gaattg	26
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gacactggcc attgatatcc gcagtacatg agatacccg ggtgcacca ttagaattgg	120
gtctaaacac catcggcaca ttgaatccgt ccacaagaga aatgtcaaag aaatcaagat	180
tgttgaactg gttccaagcg tactcggcc atgtgtttgg gtggggtacc	230
<210> 29	
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<213> Helianthus annuus	
<400> 29	
ccgagtacgc tttaaccagt	20
<210> 30	
<211> 21	
<212> DNA	
<213> Helianthus annuus	
<400> 30	

tccgcagtac atgagatacc c	21
<210> 31 <211> 29 <212> DNA <213> Helianthus annuus	
acaatgacaa cctccaccct tcccacttt	29
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<210> 33 <211> 26 <212> DNA <213> Helianthus annuus	
gaccatgtct ggcttgcctt ctcaca	26
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gagcttgagc ttagttcagt aacttaaaaa tggcc	35
<210> 35 <211> 163 <212> DNA <213> Helianthus annuus	
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<210> 36 <211> 24 <212> DNA <213> Helianthus annuus	
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<p><400> 37</p> <p>gggaagatgg aggagtactc agat</p>	24
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<p><400> 38</p> <p>cggcacgagt aactctcggt cagtgttcc</p>	29
<p><210> 39</p> <p><211> 22</p> <p><212> DNA</p> <p><213> Artificial Sequence</p>	
<p><220></p> <p><223> PCR primer corresponding to vector sequence</p>	
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<p><210> 40</p> <p><211> 26</p> <p><212> DNA</p> <p><213> Helianthus annuus</p>	
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<p><400> 41</p> <p>gctgcagctt gccaaatggg tatgta</p>	26